Lion (Panthera leo) particularities in individuals born and hand reared in captivity

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Abstract

Considering the fact that evolution of species is driven by habitats and the reproduction is a complex phenomenon interfered or influenced by many factors, a reproduction program for captive carnivores is a changeling and many programs cannot afford experimental failure. Captive carnivores pose a challenge to all institution involved in their conservation, presenting a broad pathology from diseases to poor welfare and breeding problems. Infant mortality is primarily caused by inadequate maternal behavior, either active or passive it can be connected to biological factors as well as to individual traits such origin, if they were wild- caught of captive – born. This is the main reason for research team approach in their reproduction program, hand rearing the infants. The present article presents the challenges faced by research team in their efforts to rear two lion infants, from different conceptions. The litters belonged to Barlad zoo, Vaslui County, from eastern part of Romania. Both parents were born and reared in captivity, donated to the institution during year 2014, at 3years of age, both hand reared by donor. During cubs hand rearing we developed a nutrition plan for optimal development of the infants, exposing ours mistakes has educational purpose for others so they avoid them in future.

Key words: *IUCN (International Union for Conservation of Nature), Taurine deficiency, lion hand rearing, retinopathy, Gimcat*

Introduction

The lion (*Panthera leo*) is one of the big cats in the genus *Panthera* and a member of the family *Felidae*, and from immemorial ages has represented one of the ambassador species, kept in captivity from touristic, educational and preservation purposes. At present time more than 1000 African and 100 Asiatic lions are present in zoos and animal parks all over the world.

The IUCN categorizes species according to subtle threat levels and from their perspective the lion is considered vulnerable, mainly because a population reduction of approximately 43% over the past 21years (approximately three Lion generations, 1993-2014).

Considering species decline the research group focused on gathering information's regarding in situ reproduction, and because of limited resources cannot afford experimental failure and losses. Rearing by hand the infants was the optimal approach in order to assure infants survival and reproduction program success. The offspring's were reared by personnel from the age of 2 days respectively 1 week, facing various nutritional challenges.

The decision to let the cubs with the mother as long as possible was a necessary risk, in order to obtain a minimal protection from colostrums, without passive immunization the prognosis during first two months of life is poor.

The nutritional program was formulated step by step, learning from mistakes, and must be noted the fact that on the market there are no available commercial products formulated for lions and the personnel was forced to improvise (Allen, M. E., Ullrey, D. E., & Edwards, M. S. 1999).

Materials and methods

The research group faced the challenges of hand rearing two *Panthera leo* infants from different litters, successfully raising them till maturity. The lions belonged to Zoological Garden Barlad, both adults used for reproduction are 5 year old and entered in zoo collection during year 2014 by donation (Figure 1).

A **B**

Figure 1 The lion´s parents: **A** Female Sheila; **B** Male Isac

The adults are fed with horse flesh, usually fresh meat, the exceeding flesh being stored in frigorific boxes. For dental health the lions are periodically supplied with bones from carcasses (femur, humerus, spinal cord) (Altman J., Gross K., Lowry S.2005).

The cubs belonged to different gestations and for the first days of life stayed with the mother; it was risky but they receive the majority of maternal immunity from colostrums (De Waal H. O., Osthoff G., Hugo A., Myburgh J., & Botes P. 2004), they were closely monitored by personnel and the decision to be removed was based on lack of interest the female had towards the neonates, the first cub had 627g at the time of withdrawal, two days of age (figure 2). The second cub was kept with the mother for a longer period, at the time of withdrawal weighted 1570 g at two weeks of age (figure 3).

After removal of the cubs and first clinical examination it was imperative to ensure the body temperature using infrared bulbs, mainly because the thermoregulatory center is not yet mature (hypothermia can be one of leading causes of death at this age)(Najera F., Revuelta L., Kaufman K.J. 2011).

In order to check the suckling reflex the first feeding of the neonate was done using an electrolyte, reducing the risk of aspiration into the lungs (Hedberg G., Gage L. J. 2008).

In the infant's nutrition were used six different feeding schemes meant to assure optimal nutrition, these formulas varied with age, physiological needs and digestive pathology encountered (Clauss M., Kleffner H., Kienzle E. 2010).

The main difference in formulas is the content in amino acids, more specifically the presence of taurine, essential to the development of felids, deficiency being associated with retinopathy and heart disease.

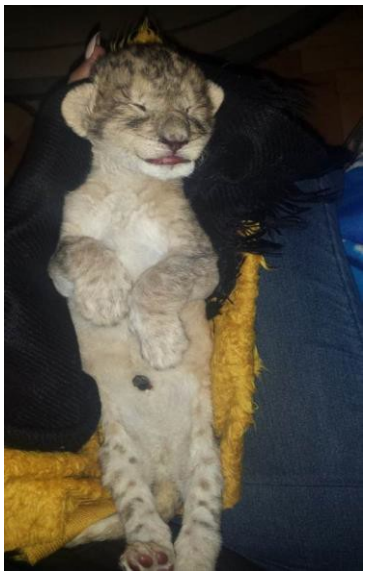

Fig. 2 King Paraschiv

Fig. 3 Thor

Scheme I cow milk 3.5% fat 40ml, cream 20% 10ml, egg yolk 7g, honey 3g (first days of life)

Scheme II Animal milk powder Can Lait (first two weeks),

Scheme III Milk powder for cats with taurine GimCat (alone till 4weeks of life),

Scheme IV Milk powder for cats with taurine Gimcat with cow sweet cheese and powdered Royal canin Babycat (until age of 10 weeks),

Scheme V Milk powder for cats with taurine Gimcatwith cow sweet cheese, powdered Royal canin Babycat and ground horse meat from age of 10 to 13 weeks),

SchemeVI raw horse meat with fresh eggs (from age of 13 weeks).

In the first week of life the feeding interval was 3h day and night. The first feeding scheme was used for the first days of life.

The Can Lait was used for the rest of two weeks, 60-80ml to each 3 hours day and night, the change in diet was necessary due to felines special need in a diet with a higher taurine content (Hedberg G. E., Dierenfeld E. S. And Rogers. Q. R., 2007).

The second choice in milk formula was the Gimcat plus taurine (table 1), used from third week.

Table 1. Nutritional values table in Gimcat -Analytical components (source http://www.gimcat.info/en/Product/vitamins/taurine/cat-milk-plus-taurine.html)

Protein	35 %	**Composition:** Milk and dairy products (63.7%), oils and fats (oil containing arachidonic acid 0.21%), vegetable by-products, lactose derivative with TGOS* (1.0%), minerals *Trans-galactooligo saccharide from milk sugar derivative
Fat content	27 %	
Crude ash	6 %	
Raw fibre	0.1 %	
Moisture	6 %	
Calcium	0.9 %	
Phosphorous	0.5 %	
Sodium	0.4 %	

From 8 weeks of age considering the rising demand for nutrients as quantity and complexity we added cow sweet cheese and powdered Royal canin Baby cat. Because of the increased consistency of portions the feeding intervals were changed to 4h during day time and 6hours during night. The administered quantity was 120-150ml (scheme IV).

After two weeks we added horse meat firstly grounded later diced meat, number of meals decreased to 4, one represented by raw meat. At 3 weeks from diversifying the diet, from 3 feedings with milk and one with meat we reached to a single milk feeding and the rest of them withmeat.

From age of 13 weeks the meat was served as big chunks twice daily (500-600g per portion) (Vester B. M., Burke S. L., Liu K. J., Dikeman C. L., Simmons L. G., Swanson K. S. 2010).

Considering the additives contained by the milk, its removal from the diet can prone the developing of organism's to vitamin and minerals deficiency. So the use of vitamin- mineral compounds should be considered to compensate the eventual imbalances (table 2) (Howard J., Rogers Q. R., Koch S. A., Goodrowe K. L., Montali R. J., Bush R. M. 1986).

In the first litter we encountered an episode of juvenile idiopathic panosteitis, around age of 4 month the cub started to limp, accusing knee and elbow joints pain, refusal to move and mourn during movement. The medication used consisted in Arthro vet Complex, Glycoflex and Osteocare syrup.

The treatment was kept for 30 days and resumed after a 14 day pause. Beneficial effects were encountered after fifteen days of treatment, discomfort diminished and the cub resumed physical activity without showing any pain or stress.

Part of the preventive medicine is parasites and infectious disease protection. At the age of 6 week, the first prophylactic deworming was done using, Merial Broadline Spot on containing: Fipronil, S-methoprene, Eprinomectin, Praziquantel (product for cestodes, nematodes and ectoparasites).

We draw attention to the main diseases mentioned to be evolving in captive and wild lion prides: canine distemper, panleucopenia, calicivirus, rhinotracheitis, feline leukemia and immunodeficiency virus (Endo Y., Uema M., Miura R., Tsukiyama-Kohara K., Tsujimoto M., Yoneda K., and Kai C., 2004).

Therefore we used a tetravalent vaccine produced by Merial the PUREVAX feline 4 vaccine, for Feline Rhinotracheitis-Calici-Panleukopenia-Chlamydia Psittaci Vaccine Modified Live Virus and Chlamydia,the inoculations begun at the age of 8week and followed by boosters at 10 week, 12 week, 6month and 1 year. The presented protocol refers to animals that will be kept in captivity and are reared by personnel, in the animals feed by mother the immune response is different because of the interference represented by passive immunity (Hofmann-Lehmann R., Fehr D., Grob M., Elgizoli M., Packer C., Martenson J. S., O'Brien S. J., Lutz H., 1996).

Table 2. Gimcat Additives
(source http://www.gimcat.info/en/Product/vitamins/taurine/cat-milk-plus-taurine.html)

Components	Quantity
Vitamin A	20,000 I.E./U.I.
Vitamin D3	2,000 I.E./U.I.
Vitamin E	100 mg
Vitamin B1	10 mg
Vitamin B2	10 mg
Vitamin B6	8 mg
Vitamin B12	60 mcg

Vitamin K3	0.2 mg
Biotin	200 mcg
Folic acid	2 mg
Niacin	80 mg
Pantothenic acid	20 mg
Vitamin C	100 mg
Choline chloride	2,500 mg
Taurine	1,000 mg
L-Carnitine	400 mg
Copper as copper-(II)-sulphate	5 mg
Iron as iron-(II)-sulphate	90 mg
Zinc as zinc sulphate	50 mg
Iodine as potassium iodide	1 mg
Manganese as manganese-(II)-sulphate	5 mg
Selenium as sodium selenite	0.1 mg
L-Arginine/L-arginine	11.6 g

In the rearing process the success is granted by providing to the cub a proper socialization, once the ear canals are open and environmental temperature allows, the cub is introduced for brief periods of time in the enclosure next to the adult facilities in order to smell and hear the rest of the group. In time the cubs will live with the entire pride. The whole process is meant to assure a safe introduction of the cub in the pride without the risk of being injured by an adult (Read, W. R., and J. E. Meier.,1996).

Results and discussion

Considering researches carried out in Barlad Zoo, county Vaslui, eastern part of Romania, on two lion cubs, from different liters, we managed to obtain following results.

Hand rearing the cubs was not an option at the very beginning, that is why we used the can lait as a substitute till the final milk option arrived (with a more suited and complete formula for lions nutritional challenges).

In the first week of life the feeding interval was 3h day and night.

During the second and third week the feeding intervals are at 3 hours during daylight and at 4 hours during nighttime.

From the fourth week the cubs were fed every 4 hours during the day and every 6 hours at night, six average feedings per day.

In the second litter the difference was obvious, the cub having a better start with an improved weight gain, must be mentioned the fact that period of time spend with his mother was up to one week fact that provided a better immune response. The second cub is more active with an improved weight gain and psychosomatic activity.

The neonate's requirements presume an intake between 10% and 20% of its body weight, a daily ration greater than 35%of body weight can cause digestive disorders.

Even if the second cub spent more time with his mother with a more suited nutrition formula (maternal milk), its weight gain was limited, and at the time of withdrawal he had only 1570g. In his case the Gimcat milk was used from the very beginning, and its qualities are reflected in the weight at 4weeks of age. Must be mentioned that female interests in cub decreased gradually and at the time of withdrawal the infant was dehydrated, but tolerated very well the substitute milk, with a good appetite from the start.

The improved condition of the second cub is presented in table 3 and in the figure 4.

Accumulating experience with two different litters we consider hand rearing of these cubs satisfactory from the point of view of psychological and behavioral outcome. The milk formula and weaning procedure provided good results, correcting the mistakes from the first litter the results were improved in a noticeable manner.

The first feeding scheme was used for the first days of life, with poor results probable because of the high carbohydrates content.

Weaning in captive felines represents one of the critical moments, mainly because some cubs poorly tolerate solid food, this is the main reason for introducing gradually various solid foods.

We believe that postponing the weaning we assured a better start for the infants. In the second litter we avoided homemade milk substitute and royal canin powdered biscuits, with better results and no digestive disturbance.

The team formulated a program able to provide repeatable results in hand rearing large carnivore's infants, in order to provide their survival, under captivity conditions.

We believe in improving the milk formula order to obtain a more suited replacement for maternal milk, as composition and digestibility (the formula used is close but improvable).

Table 3. Weight evolution in different litters

Age	Weight cub litter 1	Weight cub litter 2
At birth	627 g	-
1 week	1450 g	-
2 weeks	2200 g	1570g
3 weeks	3000 g	3800g
4 weeks	4200 g	5100g
6 weeks	5500 g	6580g
8 weeks	6700 g	8000g
10 weeks	7300 g	9007g
12 weeks	8500 g	11000g
4 months	9200 g	13000g
5 months	12 000 g	15400g
6 months	17 000 g	21000g

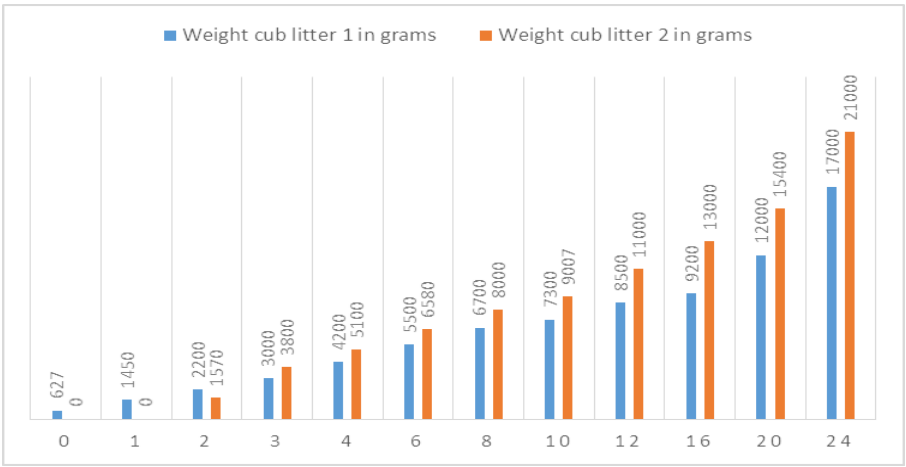

Figure 4 Weight evolution in different litters

Conclusions

1. The most suited method for lion rearing in captivity is hand rearing, this method avoids neonate's death due maternal lack of care.
2. From the products used for hand rearing, the most effective were industrial those with taurine supplementation.
3. The most difficult moment in the feeding program is represented by the raw meat introduction.
4. All feeding programs must be adjusted according individual needs, a proper physiological monitoring is demanded. Weight and neonates continuous evaluation is needed, the most important individual in the scheme is the caretaker.

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